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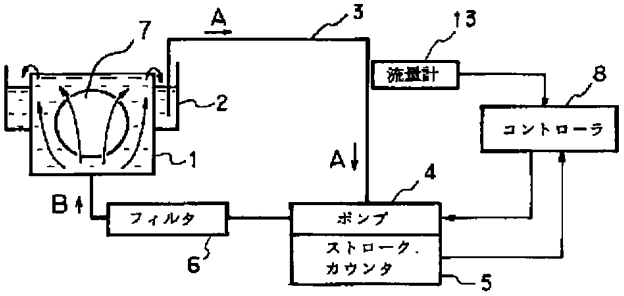
(54)【発明の名称】　ウエハ洗浄方法

(57)【要約】

【目的】　必要以上の洗浄液を用いることなく大きな洗浄効果が得られ、またウエハ面を高い洗浄効率で均一に洗浄処理可能なウエハ洗浄方法を提供する。

【構成】　洗浄槽１内に洗浄液をオーバーフローさせた状態でウエハ７の洗浄を行うウエハ洗浄方法において、前記洗浄槽内の洗浄液の流速分布を変化させながらウエハの洗浄を行う。



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【特許請求の範囲】

【請求項１】　洗浄槽内に洗浄液をオーバーフローさせた状態でウエハの洗浄を行うウエハ洗浄方法において、前記洗浄槽内の洗浄液の流速分布を変化させながらウエハの洗浄を行うことを特徴とするウエハ洗浄方法。

【請求項２】　前記洗浄槽内に供給する洗浄液のオンオフのタイミングを制御することにより前記洗浄液の流速分布を変化させることを特徴とする請求項１に記載のウエハ洗浄方法。

【請求項３】　前記洗浄槽内に供給する洗浄液の流量を制御することにより前記洗浄液の流速分布を変化させることを特徴とする請求項１に記載のウエハ洗浄方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、半導体ウエハの洗浄方法に関するものである。

【０００２】

【従来の技術】半導体製造工程において、ウエハ製造後このウエハに対し、薄膜形成処理、ドーピング処理、レジスト処理、露光処理、エッチング処理等の各種ウエハ処理が施される。これらのうち必要なウエハ処理工程終了後にウエハ上に付着した各種薬品や異物、汚れ等を除去するために、ウエハが洗浄される。通常、ウエハは洗浄槽内で薬品を用いて洗浄され、その後超純水を用いて薬品が洗浄される。このようなウェット洗浄において、従来洗浄能力の向上や効率化のため、洗浄槽に連通する洗浄処理液循環用配管上にフィルターを設けたり、処理液自体の質の向上を図ったり、あるいは大流量による処理や洗浄槽下部の処理液供給口付近に多孔整流板を設けて流速の均一化を図る等の手段が用いられている。また、メガソニック発生器による超音波洗浄やウエハ支持部の揺動機構等が用いられている。

【０００３】さらに最近では、コンピュータにより洗浄槽内の流速分布をシミュレーションのフィードバックにより求め、この演算された流速分布シミュレーションに基づいて、最大洗浄効果が得られるような洗浄槽の形状、洗浄液供給口の位置や方向および口数、ウエハ支持部の形状、ウエハの位置（高さ）およびウエハピッチ等が定められる。

【０００４】

【発明が解決しようとする課題】しかしながら、前記従来のウエハ洗浄方法における流速分布シミュレーションを用いた場合、実際の流速分布は、異種洗浄用薬液の追加や混合、経時的な濃度変化による液体粘度の変化、循環ポンプの動作変動、ウエハ径のばらつき、ウエハ枚数や流量変動等により、シミュレーションによる流速分布と異なってくる。従って、シミュレーションのフィードバックにより最大洗浄効果が得られる流速分布を求めて洗浄装置を構成しても、ウエハ面で滞留（よどみ）や対流（うず）等が発生し、所定の洗浄効果が得られなかった。この場合、実際の洗浄装置で流速分布を測定し、シミュレーションと異なる不具合な部分を発見しても、一旦設計されて組み立てられた装置の構成を変更することは、コスト的および装置稼働時期の点で好ましくない。また、この場合、所望の洗浄効果を得るために必要以上に流量を増加させて洗浄を行うことも考えられるが、ランニングコストが増加する。

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【０００５】本発明は、上記従来技術の欠点に鑑みなされたものであって、必要以上の洗浄液を用いることなく大きな洗浄効果が得られ、またウエハ面を高い洗浄効率で均一に洗浄処理可能なウエハ洗浄方法の提供を目的とする。

【０００６】

【課題を解決するための手段】前記目的を達成するため、本発明に係るウエハ洗浄方法は、洗浄槽内に洗浄液をオーバーフローさせた状態でウエハの洗浄を行うウエハ洗浄方法において、前記洗浄槽内の洗浄液の流速分布を変化させながらウエハの洗浄を行う。

【０００７】好ましい実施例においては、前記洗浄槽内に供給する洗浄液のオンオフのタイミングを制御することにより前記洗浄液の流速分布を変化させる。

【０００８】別の好ましい実施例においては、前記洗浄槽内に供給する洗浄液の流量を制御することにより前記洗浄液の流速分布を変化させる。

【０００９】

【作用】洗浄液供給のオンオフまたは流量を電気的に制御して洗浄槽内の流速分布を変化させることにより、洗浄槽内のウエハ面での局部的なよどみ部分やうずの発生が防止される。

【００１０】

【実施例】図１は、本発明の実施例に係る薬液洗浄の場合の洗浄装置の構成図である。洗浄槽１の外周にオーバーフロー槽２が設けられる。オーバーフロー槽２には薬液配管３が接続され、ポンプ４およびフィルター６を介して洗浄槽１の底部と連結される。ポンプ４には、ストロークカウンタ５が取り付けられポンプ４のストローク数を計測してポンプ４による薬液循環流量を検出する。ポンプ４はコントローラ８により駆動制御される。この場合、ストロークカウンタ５からの検出信号をコントローラ８に入力しこの入力信号に基づいてポンプ４の流量をフィードバック制御してもよい。また、管外測定タイプの超音波流量計１３を用いて常時薬液流量を検出し、この検出信号をコントローラ８に送ることによりさらに精密な流量のフィードバック制御ができる。

【００１１】洗浄すべきウエハ７は洗浄槽１内の支持部材（図示しない）上に装着され保持される。洗浄槽１内には、洗浄用薬液が一杯に充填されオーバーフローした薬液はオーバーフロー槽２に収容される。オーバーフロー槽２内の薬液はポンプ４により矢印Ａのように循環され、フィルタ６によりろ過された後、洗浄槽１の底部よ

り矢印Ｂのように槽内に供給される。この場合の供給流量は一定ではなく例えばポンプ４の駆動制御により後述のように変化させる。これにより洗浄槽１内の薬液流速分布が変化する。この場合、薬液配管３上に設けた弁（図示しない）のオンオフ制御により洗浄槽１の底部から供給する薬液を断続的にオンオフさせて流速分布を変化させてもよい。

【００１２】このような薬液による洗浄処理後のウエハ７は、ウエハ表面の薬液除去のために超純水によりさらに洗浄される。このような超純水による洗浄処理装置の構成を図２に示す。図１の例と同様に、洗浄槽１の内部にウエハ７が図示しない支持部材上に装着される。洗浄槽１の底部には純水配管１５が接続され、ユーティリティ側から矢印Ｃのように送られた超純水が、矢印Ｂのように洗浄槽１の底部から槽内部に供給される。オーバーフローした超純水は洗浄層１の下に設けたドレンパン（図示しない）から外部に排出される。純水供給配管１５上には流量制御弁１０が設けられる。配管１５を流れる超純水流量は管外測定タイプあるいはその他適当な形式の流量計１２により検出され、検出信号がコントローラ８に送られ、この検出結果に基づいて制御弁１０の開度を調整し流量のフィードバック制御を行う。

【００１３】この超純水による洗浄の場合にも、流速分布を一定とせずに、流量変化あるいは超純水供給の断続的オンオフ制御により槽内流速を変化させる。

【００１４】この場合、洗浄処理の進行状況は、抵抗計１１により洗浄槽１内の超純水の比抵抗値を検出し、超純水中の薬液量をモニターすることにより知ることができる。このような比抵抗値の変化のグラフを図４に示す。横軸は時間、縦軸は比抵抗値を表す。時間ｔ１でウエハが洗浄槽内に入れられ、時間ｔ２で取り出される。ウエハ投入直後はウエハに付着した薬液が純水中に溶けこむため比抵抗値が急激に下がり、洗浄されていくうちに次第に純水中の薬液濃度が減少して比抵抗値が増加し、徐々にウエハ投入前の超純水の値まで回復する。所定の比抵抗値の値まで回復したらウエハを取り出す。

【００１５】図３は、ウエハ洗浄処理における洗浄液（薬液または純水）の供給制御のタイムチャートである。ａのグラフは従来技術に係るタイムチャートであり、ｂ，ｃのグラフはそれぞれ本発明に係るオンオフのタイミング制御および流量制御のタイムチャートである。

【００１６】従来の場合は、グラフａに示すように、洗浄液供給配管上に設けたバルブを開き（ＯＮ）、一定流量の洗浄液を供給し、ウエハを投入する（時間ｔ１）。一定流量の洗浄液供給による一様な流速分布状態で洗浄処理終了後、ウエハを取り出し（時間ｔ２）、その後バルブを閉じる（ＯＦＦ）。

【００１７】これに対し、本発明に係るオンオフタイミング制御においては、グラフｂに示すように、ウエハ洗浄中にバルブのＯＮ／ＯＦＦを断続的に繰り返す。この場合、オンオフの時間間隔は一定の範囲内で変化させる。バルブＯＮから流速分布が安定する時間は、槽容積と流量から算出する。ＯＮからＯＦＦさせるタイミングはこの時間以上である必要がある。通常これはパラメータとして設定しておく。バルブをＯＦＦした後槽内への洗浄液供給が止まり流速分布が乱れ流速が静止するまでに、再びバルブをＯＮにする。これは、流体が静止すると洗浄処理効率が最も低い状態となるため、この時点より前に流速を戻すためである。この時間は、コンピュータによるシミュレーションからコントローラにパラメータとして設定しておく。経時的に粘度が変化する場合や処理ロット対象により流速分布が設計時と変わる場合では上記オンオフのタイミングを必要に応じて修正する。このように、洗浄処理中に洗浄液供給を断続的にオンオフしてそのタイミングを制御することにより、洗浄槽内の流速分布が変化する。

【００１８】また、本発明によるウエハ洗浄方法においては、洗浄液供給流量は例えばグラフｃのように変化する。このように流量を変化させる方法としては、洗浄液供給配管上に制御弁を設けその開度を調整する方法、配管上のオンオフ弁の駆動時間を制御する方法、定量ストロークポンプのストローク数を制御する方法、配管を複数に分岐し各分岐管上にバルブを設け開状態のバルブ数の選択により流量調整する方法等が実施可能である。このように、洗浄処理中に洗浄液供給流量を変化させることにより洗浄槽内の流速分布が変化する。

【００１９】図５は、シミュレーションによる洗浄槽１内の流速分布の例を示す。ウエハ７は支持部材１４上に装着され、洗浄液が洗浄槽１の底部の供給管１ａから矢印Ｂのように内部に供給される。Ｇは槽外へのオーバーフローの流れを示す。Ｆは対流によるうず部分を示す。また、Ｅは滞留（よどみ）の起こり易い場所を示す。このようにシミュレーションにより求めた流速分布は、本発明によれば、矢印Ｂのオンオフタイミング制御あるいは流量制御により洗浄処理中に変化する。従って、よどみ部分Ｅやうず部分Ｆの大きさや位置が変わり、ウエハ面が効率よく均一に洗浄される。

【００２０】

【発明の効果】以上説明したように、本発明に係るウエハ洗浄方法においては、薬液あるいは超純水による洗浄処理中に洗浄すべきウエハ面およびその周辺の流速分布が変化するため、従来のように大量の洗浄液を流すことなく、よどみ部分の洗浄不良や流速の大小による洗浄処理進行程度の差が解消され、洗浄作用の信頼性が向上しウエハ面が効率よく均一に洗浄処理される。

【００２１】また、流速分布変化のためのバルブのオンオフコントロールや流量コントロールは、電気的制御により行うことができるため、ハードウェアを交換することなく効率よく流速分布制御ができ洗浄処理時間の短縮

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が図られスループットが向上する。

【図面の簡単な説明】

【図１】　本発明の実施例に係る薬液処理による洗浄装置の構成図である。

【図２】　本発明の実施例に係る純水による洗浄装置の構成図である。

【図３】　洗浄液供給のタイミングチャートの説明図である。

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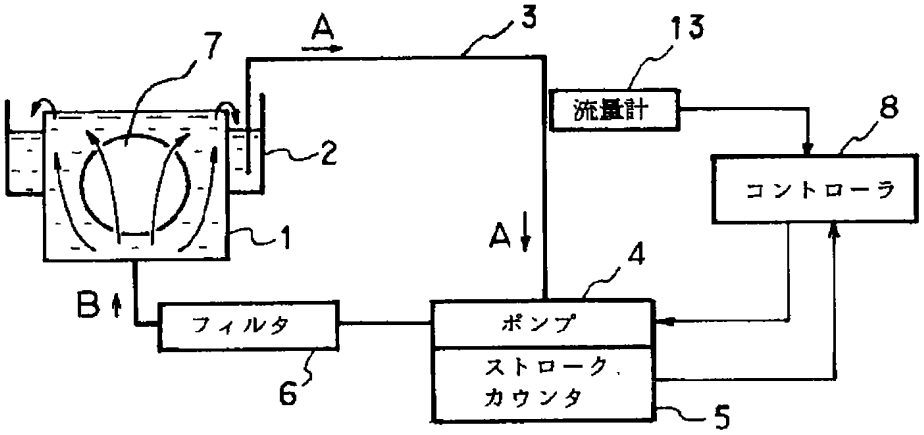
＊【図４】　洗浄液の比抵抗値曲線のグラフである。

【図５】　シミュレーションによる洗浄槽内の流速分布の説明図である。

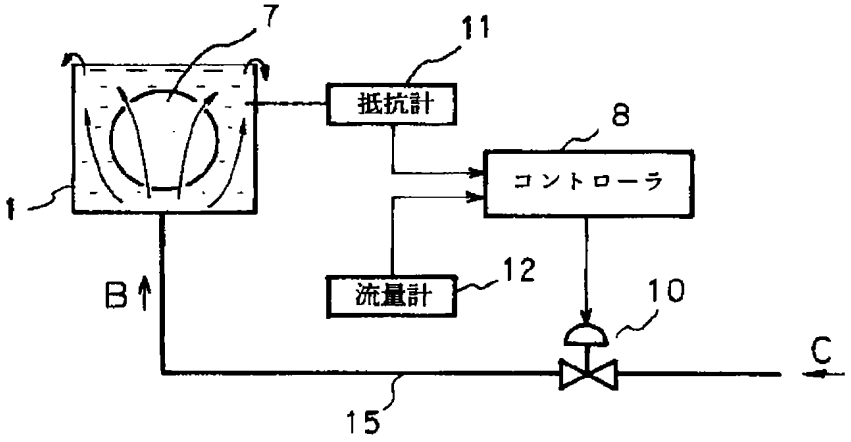
【符号の説明】

１…洗浄槽、２…オーバーフロー槽、３…薬液配管、４…ポンプ、７…ウエハ、８…コントローラ、１０…制御弁。

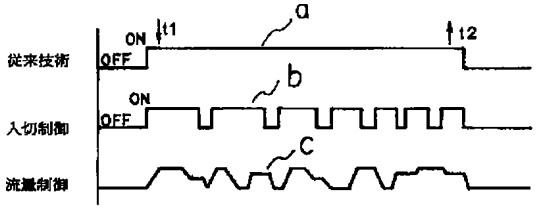
【図１】



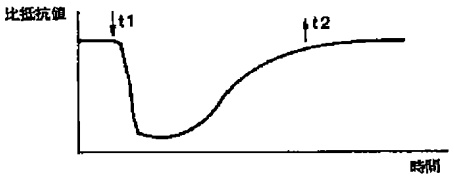
【図２】



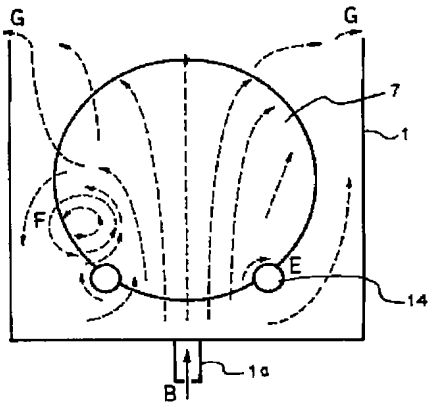
【図３】



【図４】



【図５】



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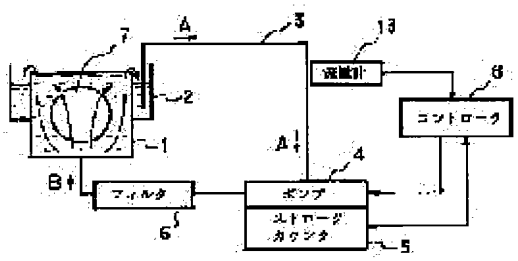
(71)Applicant : SONY CORP
(72)Inventor : MAKITA MASAHIRO

(54) METHOD FOR CLEANING WAFER

(57)Abstract:
PURPOSE: To obtain a great cleaning effect without using a cleaning solvent beyond a necessary amount and, at the same time, to uniformly clean the surface of a wafer by cleaning the wafer while the flow velocity distribution of the cleaning solvent in a cleaning tank is changed.

CONSTITUTION: A wafer 7 to be cleaned is mounted and held on a supporting member in a cleaning tank 1. The tank 1 is filled up with a cleaning chemical and the chemical overflowing the tank 1 is collected in an overflow tank 2. The chemical collected in the tank 2 is circulated in the direction shown by the arrow A by means of a pump 4 and supplied into the tank 1 from the bottom of the tank 1 through a filter 6. The supplying amount of the chemical collected in the tank 2 is not fixed, but changed by controlling, for example, the drive of the pump 4. As a result, the flow velocity distribution of the chemical in the tank I varies. Therefore, the reliability of the cleaning action of the cleaning chemical is improved and the surface of the wafer can be efficiently and uniformly cleaned.



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[Date of final disposal for application]	
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[Date of registration]	14.12.2001
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	14.12.2005

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The wafer washing approach characterized by washing a wafer, changing the velocity distribution of the penetrant remover in said cleaning tank in the wafer washing approach which washes a wafer in the condition of having made the penetrant remover overflowing in a cleaning tank.
[Claim 2] The wafer washing approach according to claim 1 characterized by changing the velocity distribution of said penetrant remover by controlling the timing of turning on and off of the penetrant remover supplied in said cleaning tank.
[Claim 3] The wafer washing approach according to claim 1 characterized by changing the velocity distribution of said penetrant remover by controlling the flow rate of the penetrant remover supplied in said cleaning tank.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the washing approach of a semi-conductor wafer.
[0002]
[Description of the Prior Art] In a semi-conductor production process, various wafer processings, such as thin film formation processing, doping processing, resist processing, exposure processing, and etching processing, are performed to this wafer after wafer manufacture. A wafer is washed in order to remove the various chemicals which adhered on the wafer after wafer down-stream-processing termination required [among these], a foreign matter, dirt, etc. Usually, a wafer is washed using a chemical in a cleaning tank, and a chemical is washed using ultrapure water after that. In such wet washing, conventionally, for improvement in washing capacity, or increase in efficiency, prepare a filter on piping for washing processing liquid circulation which is open for free passage to a cleaning tank, or the progression in quality of processing liquid itself is planned, or a porous straightening vane is formed near [by the large flow rate] the processing liquid feed hopper of processing or the cleaning tank lower part, and means, such as attaining equalization of the rate of flow, are used. Moreover, ultrasonic cleaning, a splash device of a wafer supporter, etc. by the megasonic generator are used.
[0003] Furthermore, recently, a location (height), a wafer pitch, etc. of the configuration of the location of the configuration of a cleaning tank where the velocity distribution in a cleaning tank is searched for by feedback of simulation, and the maximum cleaning effect is acquired based on this calculated velocity-distribution simulation by computer, and a penetrant remover feed hopper, a direction and talkative, and a wafer supporter, and a wafer are defined.
[0004]
[Problem(s) to be Solved by the Invention] However, when the velocity-distribution simulation in said conventional wafer washing approach is used, a actual velocity distribution differs from the velocity distribution by simulation by change of liquid viscosity, fluctuation of a circulating pump of operation, dispersion of the diameter of a wafer, wafer number of sheets, flow rate fluctuation, etc. by addition of the drug solution for different-species washing, mixing, and concentration change with time. Therefore, even if it constituted the washing station in quest of the velocity distribution from which the maximum cleaning effect is acquired by feedback of simulation, stagnation (stagnation), the convection current (eddy), etc. occurred in respect of the wafer, and a predetermined cleaning effect was not acquired. In this case, even if it discovers a nonconformity part which measures a velocity distribution with a actual washing station, and is different from simulation, it is not desirable to change the configuration of the equipment which was once designed and was assembled in respect of a cost equipment operation stage. Moreover, although washing by making a flow rate increase beyond the need is also considered in order to acquire a desired cleaning effect in this case, a running cost increases.
[0005] It is made in view of the fault of the above-mentioned conventional technique, and a big cleaning effect is acquired, without using the penetrant remover beyond the need, and this invention aims a wafer side homogeneity at offer of the wafer washing approach in which washing processing is possible at high washing effectiveness.
[0006]
[Means for Solving the Problem] In order to attain said object, the wafer washing approach concerning this invention washes a wafer, changing the velocity distribution of the penetrant remover in said cleaning tank in the wafer washing approach which washes a wafer in the condition of having made the penetrant remover overflowing in a cleaning tank.
[0007] In a desirable example, the velocity distribution of said penetrant remover is changed by controlling the timing of turning on and off of the penetrant remover supplied in said cleaning tank.
[0008] In another desirable example, the velocity distribution of said penetrant remover is changed by controlling

the flow rate of the penetrant remover supplied in said cleaning tank.
[0009]
[Function] By controlling electrically turning on and off or the flow rate of penetrant remover supply, and changing the velocity distribution in a cleaning tank, generating of the local stagnation part in the wafer side in a cleaning tank or an eddy is prevented.
[0010]
[Example] Drawing 1 is the block diagram of the washing station in drug solution washing concerning the example of this invention. The overflow tub 2 is formed in the periphery of a cleaning tank 1. The drug solution piping 3 is connected to the overflow tub 2, and it connects with the pars basilaris ossis occipitalis of a cleaning tank 1 through a pump 4 and a filter 6. The stroke counter 5 is attached in a pump 4, the stroke number of a pump 4 is measured on it, and the amount of drug solution circulating flow with a pump 4 is detected on it. Actuation control of the pump 4 is carried out by the controller 8. In this case, the detecting signal from the stroke counter 5 may be inputted into a controller 8, and feedback control of the flow rate of a pump 4 may be carried out based on this input signal. Moreover, a drug solution flow rate is always detected using the ultrasonic flowmeter 13 of the measurement type outside tubing, and feedback control of a still more precise flow rate can be performed by sending this detecting signal to a controller 8.
[0011] It is equipped with the wafer 7 which should be washed on the supporter material in a cleaning tank 1 (not shown), and it is held. The drug solution which was filled up with the drug solution for washing to the limit, and it overflowed in the cleaning tank 1 is held in the overflow tub 2. After circulating through the drug solution in the overflow tub 2 like an arrow head A with a pump 4 and filtering it with a filter 6, it is supplied in a tub like [pars basilaris ossis occipitalis / of a cleaning tank 1] an arrow head B. The supply flow rate in this case is not fixed, for example, is changed like the after-mentioned by actuation control of a pump 4. Thereby, the drug solution velocity distribution in a cleaning tank 1 changes. In this case, the drug solution supplied from the pars basilaris ossis occipitalis of a cleaning tank 1 by the on-off control of the valve (not shown) prepared on the drug solution piping 3 may be made to turn on and off intermittently, and a velocity distribution may be changed.
[0012] The wafer 7 after the washing processing by such drug solution is further washed by ultrapure water for the drug solution clearance on the front face of a wafer. The configuration of the washing processor by such ultrapure water is shown in drawing 2 . It is equipped like the example of drawing 1 on the supporter material which a wafer 7 does not illustrate inside a cleaning tank 1. The pure-water piping 15 is connected to the pars basilaris ossis occipitalis of a cleaning tank 1, and the ultrapure water sent like an arrow head C from the utility side is supplied to the interior of a tub from the pars basilaris ossis occipitalis of a cleaning tank 1 like an arrow head B. The overflowing ultrapure water is discharged outside from the drain pan (not shown) prepared in the bottom of the washing layer 1. A flow control valve 10 is formed on the pure-water charging line 15. By being detected by the flowmeter 12 of the measurement type outside tubing, or a format suitable in addition to this, a detecting signal is sent to a controller 8, and adjusts the opening of a control valve 10 based on this detection result, and, as for the ultrapure water flow rate which flows piping 15, feedback control of a flow rate is performed.
[0013] Also in washing by this ultrapure water, the rate of flow in a tub is changed by the intermittent on-off control of flow rate change or ultrapure water supply, without seting a velocity distribution constant.
[0014] In this case, the progress situation of washing processing can detect the resistivity of the ultrapure water in a cleaning tank 1 with a ohm-meter 11, and can know it by acting as the monitor of the amount of drug solutions in ultrapure water. The graph of such a specific resistance value change is shown in drawing 4 . An axis of abscissa expresses time amount and an axis of ordinate expresses resistivity. It is put into a wafer in a cleaning tank by time amount t1, and is taken out by time amount t2. Immediately after the wafer charge, since the drug solution adhering to a wafer melts into pure water, resistivity falls rapidly, while being washed, the drug solution concentration in pure water decreases gradually, and resistivity increases, and it recovers to the value of the ultrapure water before the wafer charge gradually. A wafer will be taken out if it recovers to the value of predetermined resistivity.
[0015] Drawing 3 is the timing diagram of supply control of the penetrant remover (a drug solution or pure water) in wafer washing processing. The graph of a is a timing diagram concerning the conventional technique, and the graph of b and c is the timing diagram of the timing control of turning on and off concerning this invention, and control of flow, respectively.
[0016] As shown in Graph a, in the conventional case, the penetrant remover of an aperture (ON) and constant flow is supplied for the bulb prepared on the penetrant remover charging line, and it throws in a wafer (time amount t1). A bulb is closed for a wafer ejection (time amount t2) and after that after washing processing termination by the uniform rate-of-flow part blanket-like voice by penetrant remover supply of constant flow (OFF).

[0017] On the other hand, in the on-off timing control concerning this invention, as shown in Graph b, ON/OFF of a bulb is intermittently repeated during wafer washing. In this case, the time interval of turning on and off is changed within fixed limits. The time amount by which a velocity distribution is stabilized from Bulb ON is computed from the tub volume and a flow rate. The timing made to turn off from ON needs to be beyond this time amount. Usually, this is set up as a parameter. After turning off a bulb, a velocity distribution will turn ON a bulb again by penetrant remover supply into a tub stopping, by the time the turbulence rate of flow stands it still. Since washing processing effectiveness will be in the lowest condition if a fluid stands it still, this is for returning the rate of flow before this event. This time amount is set as the controller as a parameter from the simulation by the computer. In the case where a velocity distribution changes with the time of a design the case where viscosity changes with time, and for a processing lot, the timing of the above-mentioned turning on and off is corrected if needed. Thus, the velocity distribution in a cleaning tank changes by turning penetrant remover supply on and off intermittently, and controlling the timing during washing processing.
[0018] Moreover, in the wafer washing approach by this invention, a penetrant remover supply flow rate changes like for example, the graph c. Thus, the approach of preparing a control valve and adjusting the opening on a penetrant remover charging line as an approach of changing a flow rate, the approach of controlling the actuation time amount of the on-off valve on piping, the approach of controlling the stroke number of a quantum stroke pump, the approach branch piping to plurality, and prepare a bulb on each branch pipe, and the flow of [approach] is controlled by selection of the number of bulbs of an open condition can be enforced. Thus, the velocity distribution in a cleaning tank changes by changing a penetrant remover supply flow rate during washing processing.
[0019] Drawing 5 shows the example of the velocity distribution in the cleaning tank 1 by simulation. It is equipped with a wafer 7 on the supporter material 14, and a penetrant remover is supplied to the interior like an arrow head B from supply pipe 1a of the pars basilaris ossis occipitalis of a cleaning tank 1. G shows the flow of overflow out of a tub. F shows the eddy part by the convection current. Moreover, E shows the location where stagnation (stagnation) tends to take place. Thus, according to this invention, the velocity distribution searched for by simulation changes with the on-off timing control or control of flow of an arrow head B during washing processing. Therefore, the magnitude and the location of the stagnation part E and the eddy part F change, and a wafer side is efficiently washed by homogeneity.
[0020]
[Effect of the Invention] Without passing the penetrant remover of a large quantity like before, since the wafer side which should be washed during the washing processing by the drug solution or ultrapure water, and the velocity distribution of the circumference of it change in the wafer washing approach concerning this invention as explained above, poor washing of a stagnation part and the difference of washing processing progress extent by the size of the rate of flow are canceled, the dependability of detergency improves, and washing processing of the wafer side is carried out efficiently at homogeneity.
[0021] Moreover, since electric control can perform the on-off control and flow control of a bulb for velocity-distribution change, without exchanging hardware, the rate-of-flow distribution control can be performed efficiently, compaction of the washing processing time is achieved, and its throughput improves.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the washing station by the drug solution processing concerning the example of this invention.
[Drawing 2] It is the block diagram of the washing station by the pure water concerning the example of this invention.
[Drawing 3] It is the explanatory view of the timing chart of penetrant remover supply.
[Drawing 4] It is the graph of the resistivity curve of a penetrant remover.
[Drawing 5] It is the explanatory view of the velocity distribution in the cleaning tank by simulation.
[Description of Notations]
1 [-- A pump, 7 / -- A wafer, 8 / -- A controller, 10 / -- Control valve.] -- A cleaning tank, 2 -- An overflow tub, 3 -- Drug solution piping, 4

[Translation done.]